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09/648,111	08/25/2000	Kwang-Jo Hwang	3430-0131P	5562

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EXAMINER
BROCK II, PAUL E

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 06/26/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/648,111	Applicant(s) HWANG, KWANG-JO	
	Examin r Paul E Brock II	Art Unit 2815	

-- Th MAILING DATE of this communication appears on the cov r sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 May 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11 and 13-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 August 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 2, 5 – 9, 11, 13, 15, 16, 20 – 22, 24 and 28 – 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (USPAT 5771110, Hirano) in view of Chen (USPAT 6133145).

Hirano discloses in figures 1 – 16 a method of manufacturing a liquid crystal display device.

With regard to claim 1, Hirano discloses in figures 1 – 8 forming a switching element (2 – 7) on a substrate (1). Hirano discloses in figure 13 forming a passivation layer (14) over the substrate. Hirano discloses in figure 14 depositing a metal layer (16) on the passivation layer. Hirano discloses in column 12, lines 54 – 60 forming a photoresist pattern on the metal layer, such that a portion of the metal layer is exposed. Hirano discloses in figure 15 and column 12, lines 54 – 60 etching a portion of the metal layer to form a pixel electrode. Hirano does not teach treating the exposed portion of the metal layer with a first plasma, prior to etching. Chen teaches in figures 5 and 6 and column 4, lines 16 – 24 treating an exposed portion of a metal layer (10a) with a first plasma (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24),

prior to any step of etching a photoresist pattern (12b), and prior to any step of etching the metal layer, using the photoresist as a mask, to lower a binding force in the exposed portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the treating method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

With regard to claim 2, Hirano discloses in column 11, line 63 wherein the switching element is a thin film transistor.

With regard to claim 5, Chen teaches in figure 5 and column 4, lines 16 – 24 using a non-reactive gas to lower a binding force in the exposed portion.

With regard to claim 6, Chen discloses in figure 5 and column 4, lines 16 – 24 wherein the non-reactive gas includes N_2.

With regard to claim 7, Hirano discloses in column 12, lines 54 – 60 the step of etching the metal layer involves a dry-etching technique.

With regard to claim 8, Hirano discloses in column 12, lines 54 – 60 the step of etching the metal layer includes etching the metal layer with HBr plasma gas.

With regard to claim 9, Hirano discloses in column 12, lines 54 – 60 the step of etching the metal layer includes etching the metal layer with a composition of HBr plasma gas and Cl_2 plasma gas.

With regard to claim 11, Hirano discloses in column 12, lines 48 – 60 the metal layer is indium tin oxide (ITO).

With regard to claim 30, Hirano discloses in figure 14 depositing a metal layer (16) on a passivation layer (14) which partially covers a transistor (2 – 7). Hirano discloses in column 12,

lines 48 – 60 forming a photoresist pattern on the metal layer, leaving a portion of the metal layer uncovered. Hirano discloses in column 12, lines 57 – 60 etching the uncovered portion of the metal layer with a second plasma to form a pixel electrode. Hirano does not teach exposing the uncovered portion of the metal layer to a first plasma, prior to etching. Chen teaches in figure 5 and column 4, lines 16 – 24 exposing an uncovered portion of a metal layer (10a) to at least one first gas (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching a photoresist pattern (12b) and prior to any step of etching the metal layer to lower a binding force in the uncovered portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the exposing method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

With regard to claim 13, Chen discloses in figure 5 and column 4, lines 16 – 24 wherein the first gas is a reactive gas.

With regard to claim 15, Chen teaches in figure 5 and column 4, lines 16 – 24 wherein the first gas is a non-reactive gas.

With regard to claim 16, Chen discloses in figure 5 and column 4, lines 16 – 24 wherein the non-reactive gas includes N_2.

With regard to claim 20, Hirano discloses in column 12, lines 48 – 60 wherein the metal layer is indium tin oxide (ITO).

With regard to claim 21, Hirano discloses in figure 15 removing the photoresist pattern from the pixel electrode.

With regard to claim 22, Hirano discloses in figure 14, depositing a metal layer (16) over a substrate (1). Hirano discloses in column 12, lines 54 – 60 forming a mask on the metal layer,

leaving a portion of the metal layer uncovered. Hirano discloses in column 12, lines 57 – 60 etching the uncovered portion of the metal layer with a second plasma to form a metal pattern. Hirano does not teach exposing the uncovered portion of the metal layer to a first plasma, prior to etching. Chen teaches in figure 5 and column 4, lines 13 – 24 exposing an uncovered portion of a metal layer (10a) to a first plasma (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching a mask (12b), and prior to any step of etching the metal layer, to lower a binding force in the uncovered portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the exposing method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

With regard to claim 24, Chen teaches in figure 5 and column 4, lines 13 – 24 wherein the first plasma includes N_2.

With regard to claim 28, Hirano discloses in column 12, lines 48 – 60 the metal layer is indium tin oxide (ITO).

With regard to claim 29, Hirano discloses in figure 15 that the metal pattern includes a pixel electrode of a display device.

With regard to claim 31, Hirano discloses in figure 14 depositing a metal layer (16) on a passivation layer (14) which partially covers a transistor (2 – 7). Hirano discloses in column 12, lines 48 – 60 forming a photoresist pattern adjacent to the metal layer, leaving a portion of the metal layer uncovered. Hirano discloses in column 12, lines 57 – 60 etching the uncovered portion of the metal layer with a second plasma to form a pixel electrode. Hirano does not teach exposing the uncovered portion of the metal layer to a first plasma, prior to etching. Chen teaches in figure 5 and column 4, lines 16 – 24 exposing an exposed portion of a metal layer

(10a) to at least one first gas (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching, to lower a binding force in the uncovered portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the exposing method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

3. Claims 10, 17 – 19, and 25 – 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano and Chen as applied to claims 1, 7, 22 and 30 respectively, above, and further in view of Ye et al. (USPAT 5968847, Ye).

With regard to claim 10, Hirano and Chen do not disclose the combination of HBr and CH_4 as plasma gasses. Ye teaches in column 12, lines 55 – 62 that a composition of HBr and CH_4 can be used for etching a metal layer. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the composition of HBr and CH_4 for etching a metal layer because both are well known etching gasses that are readily available in a production fabrication facility.

With regard to claims 17 and 18, Hirano discloses at least one second gas that includes Cl_2. Hirano and Chen do not disclose that the at least one second gas includes an HBr plasma gas. Ye teaches in column 5, lines 15 – 20 at least one second gas that includes an HBr plasma gas. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the HBr plasma gas of Ye as an additional gas with Cl_2 in the second etch step of Hirano and Chen for etching a metal layer in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

With regard to claims 25 and 26, Hirano discloses a second plasma gas that includes Cl_2. Hirano and Chen do not disclose that the second plasma gas includes an HBr plasma gas. Ye teaches in column 5, lines 15 – 20 a plasma that includes both HBr and Cl_2 for removing a metal layer. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the HBr plasma gas of Ye as an additional gas with Cl_2 in the second etch step of Hirano and Chen for etching a metal layer in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

With regard to claim 19, Hirano discloses at least one second gas that includes Cl_2. Hirano and Chen do not teach the use of HBr and CH_4 as etching gasses. Ye discloses in column 5, lines 15 – 20 the use of HBr and CH_4 in the same metal etch step that just Cl_2 is used. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the combination of HBr and CH_4 of Ye as a substitute gas for Cl_2 of Hirano and Chen in the second etching step in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

With regard to claim 27 , Hirano discloses the use of Cl_2 for the second etching step. Hirano and Chen do not teach the use of HBr and CH_4 as etching gasses. Ye discloses in column 5, lines 15 – 20 the use of HBr and CH_4 in the same metal etch step that just Cl_2 is used in. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the combination of HBr and CH_4 of Ye as a substitute gas for Cl_2 of Hirano and Chen in the second etching step in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

4. Claims 3, 4, 14, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano and Chen as applied to claims 1, 13, 22 and 30, respectively, above, and further in view of Muraguchi et al. (JPPAT 361002368, Muraguchi).

With regard to claim 3, Hirano and Chen do not teach the step of treating the exposed portion of the metal layers includes using a reactive gas. Muraguchi teaches in the Constitution using a reactive gas in a step of treating an exposed portion of a metal layer to lower a binding force in the exposed portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the reactive gas of Muraguchi in the method of Hirano and Chen in order to reduce oxygen atoms without resulting in crystal damage to the surface.

With regard to claims 4 and 14, Muraguchi discloses that the reactive gas is H_2.

With regard to claim 23, for the same reasons as stated above with regard to claims 3, 4 and 14 it would have been obvious to use the H_2 plasma gas of Mohri in the first plasma of Hirano.

Response to Arguments

5. Applicant's arguments filed May 27, 2003 have been fully considered but they are not persuasive.

6. In response to applicant's argument that "it is clear that Chen chose not to lower a binding force in the metal to obtain or maintain the desired high selectivity, but rather, Chan chose to increase a binding force in the photoresist," a recitation of the intended use of the claimed

invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Therefore, the applicant's arguments are not persuasive, and the rejection is proper.

7. Further, even if the intended use recitation of "to lower a binding force in the exposed portion [of the metal]" did define a patentable limitation, Chen does teach this limitation. It is clear that, in relation to the binding force of the photoresist, the binding force in the metal is lowered after the plasma treatment. For example, while keeping the absolute value of the binding force of the metal constant "K" as argued by the applicant, the binding force in the metal with respect to the photoresist is "x" before the plasma treatment, and "y" after the plasma treatment. It follows that, because the binding force in the photoresist of Chen has been increased, the second ratio "y" would be lower than "x". In other words, since the absolute value of the binding force of the metal is kept constant "K" as argued by the applicant, the binding force in the metal as compared to the binding force in the photoresist after the plasma treatment "y" is lower than a binding force in the metal as compared to the photoresist before the plasma treatment "x" (i.e. $K/100 < K/10$) . The open claim language as presented in the pending claims does not distinguish over this fact. Therefore, the applicant's arguments are not persuasive, and the rejection is proper.

8. With regard to the applicant's argument that "photoresist pattern 12b is not formed on metal layer 10a, but rather, it is formed on titanium nitride layer 11b," it should also be noted that titanium nitride layer 11b is formed on metal layer 10a. Since photoresist pattern 12b is formed on titanium nitride layer 11b, which is formed on metal layer 10a, it follows that photoresist pattern 12b is formed on metal layer 10a as presented in figure 5 of Chen. The open claim language as presented in the pending claims does not distinguish over this fact. Therefore, the applicant's arguments are not persuasive, and the rejection is proper.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul E Brock II whose telephone number is (703)308-6236. The examiner can normally be reached on 8:30 AM-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703)308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Paul E Brock II
June 20, 2003

EDDIE LEE
SUPERVISORY PATENT EXAMINER
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